BYOD and Open Source Learning in the 21st Century Classroom

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Abstract

BYOD and F/OSS is a growing trend that over the past eight years has changed the landscape of most learning institutions. BYOD is the use of personal technology devices in the classroom to enhance the learning. F/OSS is free or open source software that can be used in classes to accentuate the learning, and enhance student productivity. The earliest presence of BYOD and F/OSS was seen on the college/university level. Higher-level learning institutions quickly adopted technology use and allowed students to incorporate their devices in the classroom quickly. Now most college and universities expect their students to purchase and bring technology with them in class to enhance the learning environment. Most professors require their students to interact with them in a digital format, including assessments. Unfortunately, we have not seen the same pace in adoption and overall use of technology in grades K-12. Typically in education there exists a multi-year gap in technology device age and usage, but the large difference in this gap between primary and higher education is creating a significant disadvantage for our graduating high school seniors. One of the biggest factors that keep 1-to-1, or BYOD from fully being utilized in K-12 education are school budgets. The great news here however is that devices are becoming cheaper and cheaper and running free and open source software on these devices allows them to be a powerful learning tool, overcoming the budget obstacle. BYOD with F/OSS can be used in every classroom, every grade level, and subject enhancing the learning that already goes on. By introducing BYOD coupled with F/OSS schools are addressing effective technology use, keeping budgets in check, while arming their students with 21st century college and career skills.

Key words: BYOD, 1-to-1 device initiative, F/OSS, Open Source Software

Introduction

http://youtu.be/ZL4ssuCDRXs (why BYOD is needed in schools)

Think back to when you were a student. Books were used along with paper and pencil to track thinking. All learning was done through lecture and some group work. All students completed the same assignment without differentiation. Computers were used by the office staff and rarely available for student use. When you think back, learning was not designed for you as an individual, learning was designed for a one size fits all approach.

The 21st century learner of today does not fit this model. Times have changed within the classroom and now the push for technology within the classroom has created a whole new approach to learning and curriculum. The need for students to bring in their own devices has spiked significantly. Districts are buying technology at an alarming rate in order to keep up with the changing times. Common core has pushed districts to spend money that they don't have in order for students to master standards. So what does all of this mean?

What is BYOD?

To understand why the push for technology, you need to understand what the term BYOD means. BYOD, commonly known as "Bring your own device" is a movement that schools are looking at in order to save money on technology upgrades and purchases. There are many risks with adapting a BYOD policy but as many schools make this move, the risks tend to outweigh the rewards. Bonk's (2009) theory states that through the acronym WE ALL LEARN, students are able to learn at their own pace and capture the world within their hands. WE ALL LEARN is designed to be used with this BYOD movement and at anytime or at anyplace, information is within your reach. If you take into consideration the 21st century learner, this type

of student has grown up in a world of want it now, need it now. Through fostering the BYOD initiative, schools are able to cater to these learners and improve the learning experience.

http://youtu.be/OVTu8yR5ZrU (why open education matters? open source for education)

What is F/OSS?

Through the push for BYOD in school districts, another hot technology topic being seen currently in schools is the move to implement more free and open source software into classroom instruction. Programs such as Moodle provide opportunities for schools to implement an online type of learning environment for no cost. When schools are able to implement more F/OSS into the curriculum, students are exposed to more online learning and self-guided instruction. The new common core standards have teachers frantically searching for websites that allow for self-paced learning and incorporate a virtual learning feel. Districts that are strapped for cash are jumping at the opportunity to incorporate some of these programs into the curriculum because of little to no cost for these programs. Through the Common Core initiative, teachers become more of a facilitator when it comes to student learning. With the big push to have students graduate with computer skills, the F/OSS initiative allows for students to not only learn appropriate content but develop the crucial skills that are needed in the work force once students enter the workforce.

Current need for BYOD with F/OSS in our schools

An interview conducted with educational technology teacher Dennis Murphy (2014) discussed the importance of training for staff members when it comes to implementation of new technologies. Currently, school districts are experiencing budget cuts that have impacted the technology movement within the districts. Without the funding that can be provided for schools, the students and teachers will not be able to keep up with the rigorous expectations of the

Common Core. Core subjects that are expected to implement more technology are going to be the areas that struggle with the change (Murphy, 2014). Providing support to those core areas will help all meet the requirements and adjust to the changes. Funding is going to be what stops schools from keeping up with and incorporating more technology into the curriculum (Murphy, 2014). With all of the changes due to the new Common Core initiative and the lack of funds within schools, districts are hoping to eventually adapt a BYOD policy for students so that all students are able to experience the virtual learning environment and access some of those F/OSS programs that will enhance the learning experience. Throughout this literature review, you will be exposed to data and research that supports the usage of BYOD and F/OSS within our schools.

Theoretical Design

BYOD, as mentioned earlier, is a recent concept in which to save money in educational programs. However, there is a more important concept in a BYOD program that focuses more on the learning that takes place using BYOD programs. The BYOD program allows students, or learners, to take control of their own learning, their own knowledge intake. Teachers deliver the information while students attempt to remember the information in whatever note taking style is recommended for that week, is soon to be seen less and less. This concept of student-led instruction has been in the educational theory discussions since Jean Piaget introduced the cognitive theory of Constructivism since the early to mid-twentieth century (Ouyang & Stanley, 2014).

To understand the educational theory behind BYOD, a historical review is required. The word “students” and “learners” are interchangeable since technology and BYOD are for all ages and one is constantly learning.

By the 1980's computers became available for personal use due to improved technology. In malls across the nation, learners practiced within the Objective theory, inspired by B. F. Skinner. (Enonbun, 2010) when playing a simple video game called Pac-Man™. The player would receive positive reinforcement when the points increased and celebratory music played. Likewise, the player received negative reinforcement when the game piece was destroyed, points stopped accruing, and a decreasing harmonic would play. Behaviors began to change based on the stimulus-response (Enonbun, 2010) as more and more video games began to flood the malls.

Meanwhile, in classrooms, students began to become exposed to huge desktop computers in computer labs that were limited to selected individuals for a specific class. The software programming required coding knowledge to operate. The user was rewarded every day with thousands of positive and hopefully fewer negative responses as keys were typed to complete tasks. The computer was as much a tool as a calculator or a hammer. Even today, when technology responds positively, behaviors will not change. However, when technology is not responding positively, behaviors seemingly become more aggressive and agitated with the learner exhibiting loud outbursts of a variety of sounds.

Soon, through a lot of technological advancements, students or learners, began to experiment with virtual technology where the individual wearing computerized headgear that was hooked to a machine that had another player with the same type headgear adorned to create a virtual 3D environment. Even though the technology was becoming smaller and gaming software was becoming more sophisticated, objective learning was still prevalent.

Then, technology became mobile. Students were no longer restricted to desktops in a computer lab. The Internet became radio waves emitted through the air instead of through wires or cables. Programming and hardware allowed Internet access outside the classroom. Software

programs became more user friendly using icon buttons to manipulate commands. Word processing software was streamlined so written communication became efficient. Technology became more affordable for more people. Learners became students in whatever subject of interest.

Bonk (2009) introduced Seymour Papert as a student of Jean Piaget in the 1960's when computers were still room-sized. According to Bonk (2009) Papert was a leader in children's thinking, learning theory, and constructivism. Papert expanded the idea of students constructing their own learning to using that learning to build something publicly visible, thus constructionism built from constructivism.

As the technological hardware became smaller and more affordable, the software became more user-friendly. The Internet is more accessible and affordable. Students can now access information to gain knowledge outside the typical school day. The BYOD program takes advantage of the advancements while incorporating the constructionist approach to learning. Teachers facilitate instruction while students use their own mobile device to access the information needed to complete the assignment, whether it is to build a paper or to build a robot. With the advancements in Web 2.0, students can construct knowledge while collaborating with other learners through the use of blogs, wikis, and social media incorporating a more social constructionist approach.

Implementation

According to the 2009 Kaiser Family Foundation report (Lai, Khaddage, and Knezek, 2013), children in the United States from the ages of 8-18 spent 90 minutes per day in 2009 texting; 82 minutes per day participating in voice communications, listening to music, playing games, or watching media; and 90 minutes per day participating in social networking. This

equates to 262 minutes or 4.5 hours using technology outside of the formal educational arena. Grant and Barbour (2013) report 83% of 17-year-olds, 75% of teenagers, and 58% of 12-year-olds in the United States own a cell phone. With this many students owning cell phones who use them for a wide variety of communication, allowing them to utilize these skills in the classroom seems as logical as allowing students to continue using crayons in art and pencils in class when these tools are used outside the classroom years before they first step into formal education.

Many schools have policies of prohibiting cell phones in the schools due to the disruption they would make in the classroom. However, with data as previously mentioned many schools have decided to take advantage of this available technology and use it in the classroom using the Bring Your Own Device (BYOD) programs.

Implementing a BYOD program may seem simple at first glance assuming that students just bring in their devices and classroom instruction would continue as normal. There are many considerations in establishing a BYOD program. There is data to gather, stakeholders to persuade, broadband widths to increase, legalities to review, new policies to make, lesson planning to change, and educators to train.

Before a school system implements a BYOD program, some data needs to be collected. For example, a survey of the number of students who own mobile devices such as cell phones, tablets, or electronic notebooks, or laptops. This data will help determine a starting point. For some districts it is possible that this data will determine that not enough students own their own mobile devices to start. Research may need to ensue to find a resource to assist in acquiring tablets or other mobile devices.

Parents/guardians, teachers, and the district and school administrations have to be invested into the BYOD development (Parsons, 2012). In some districts, the county

administration may need to be involved in dealing with the school budget. Parents/guardians need to have a voice in the decision making since their child will be directly affected if they do not have the luxury of owning a personal mobile device. According to the 2010 census, 22% of children in the United States, or 16.4 million children, live in poverty; children of color experience higher rates of poverty than do Caucasian children, 18% of children have one unemployed or underemployed parent, and 1.6 million children are homeless (Adams, 2012). Teachers not only need to be concerned about lesson planning and implementation, they also need to be concerned with ensuring all the students have equal access to the technology. This is also a burden for the district and school administrators.

A team of information technology Subject Matter Experts (SME) needs to be involved to research and present any possible upgrades within the school system infrastructure to account for the increased number of devices (Parsons, 2012) and all the supports that go along with this. Parsons (2012) counsels that using a wireless network that provides adequate coverage and speed for the estimated large number of devices that are used simultaneously is a basic necessity for upgrading the network infrastructure. Other infrastructure items include teacher's devices and professional development, software purchases for the students, and software purchase for the learning management system (Parson, 2012; Lennon, 2012). Software license management needs to be included (Lennon, 2012). Cyber security and data management software needs to be researched, purchased, and implemented as well as adequately maintained (Evans, 2014).

Acquiring and maintaining legal counsel is required to ensure the rights and privacy of the students and the school system are upheld throughout the BYOD program (Evans, 2014). Stakeholders need to ensure that the school system has clear and practical policies, security measures are in place to ensure private confidential personal information stays secure, and a

clear and precise explanation of how the school uses information obtained through this program (Evans, 2014).

Any BYOD implementation will require an increase in monetary spending. The specific amount is determined by the needs. Throughout the course of a year, once the initial investment is done, the annual renewals or upgrades will be minimal (Parsons, 2012). Because the student is supplying their own hardware, the budgetary line item cost of hardware for items such as desktops computers and the peripherals (mouse and keyboard) or laptops are dramatically reduced if not eliminated (Parsons, 2012). Therefore, technical support costs and maintenance will be reduced (Parsons, 2012). Some schools may be able to eliminate an old computer lab (Parsons, 2012) opening that space for other instruction.

Implementation F/OSS

For BYOD to work Open Source Software (OSS) is required whether the OSS is from a private "cloud" or a public "cloud." In regards to K-12 education sites with limited funds, Free Open Source Software (F/OSS) is best since there are no fees associated with its use.

Online education institutions, such as college and universities, use F/OSS or a combination of this with private OSS. For example, Lennon (2012) describes the blended setup at the Letterkenny Institute of Technology (LYIT) in Ireland. LYIT uses the Blackboard learning management system on a public "cloud" (Lennon, 2012). Many United States universities and colleges use Blackboard, as well. The public "cloud" is used for storage allowing each student to have a 25GB storage folder on SkyDrive (Lennon, 2012) which at the writing of this review, the OneDrive.

Moodle (https://moodle.org) is another example of an OSS learning management system (Bansode and Kumbhar, 2012). From the Moodle website, it proclaims that Moodle operates from funds provided by 60 partners worldwide allowing Moodle users free access and usage.

The stakeholders will need to discuss their needs and the options that will meet those needs with the technical SMEs to ensure the school district is investing time, effort, and capital wisely.

Implementing BYOD and F/OSS in the K-12 Classroom

Once decided to use BYOD and which F/OSS or OSS learning management systems to use, many instructional options can be used inside the classroom. Kiger, Herro, and Prunty (2012) suggest one-to-one computing that not only use laptops or tablets, but can use smartphones. Many schools use Apple products such as iPad tablets that can access e-reading, calculating, mapping, Internet browsing, and gaming (Kiger, Herro & Prunty, 2012) specifically designed for easy use for young children.

Many classrooms are trying the Flipped classroom design which focuses on Internet use at home to view the lectures or complete the reading assignment and notes (Kiger, Herro & Prunty, 2012). When the students arrive in class the following day, questions from the night before are answered and practice sessions commence (Kiger, Herro & Prunty, 2012). The arts and other academic are not omitted from this new technology. The use of iPods, another Apple product, allow music, video and audio downloads (Kiger, Herro & Prunty, 2012).

Research

Technology is a part of our everyday life so much so that it has impacted the way students learn and explore the world. If implemented correctly, technology can make education

more significant and meaningful to students. Below are research articles in which studies show support, with pros and cons, for BYOD and F/OSS implementation in schools. Common topics discussed in the articles include: increased student achievement, affordability, and increased student collaboration.

Research in the article entitled "Examining the Influence of a Mobile Learning Intervention on Third Grade Math Achievement" was conducted by a team of three employed by the Oconomowoc School District in Wisconsin (Kiger, Herro, & Prunty, 2012). The study was conducted with two third-grade intact classrooms (46 students, two teachers) that used the Everyday Mathematics-University of Chicago Mathematics project (EM) and daily practice using flashcards to learn multiplication while the other intact classroom (41 students, two teachers) coupled EM with Mobile Learning Intervention (MLI) and daily practice using iPod touch devices loaded with selected math apps (Kiger et al., 2012). All participating students and teachers completed a pre-intervention survey to identify and control for pre-existing group differences (Kiger et al., 2012). Other pre-intervention data pertaining to test scores and grades, as well as school attendance records, were collected. The research team equipped the iPod touch device with the following math apps: Multiplication Genius Lite (Kiger et al., 2012), Mad Math Lite (Kiger, et al., 2012), Pop Math (Kiger, et al., 2012), Flash to Pass (Kiger et al., 2012), Math Drills Lite (Kiger et al., 2012), Math Tappers: Multiples (Kiger et al., 2012), Multiplication Flashcards to Go (Kiger et al., 2012), Brain Thaw (Kiger, et al., 2012), Math Magic (Kiger, et al., 2012), and FlowMath (Kiger et al., 2012). The MLI students used the iPod touch devices and math apps to practice each day during a 10-minute period as directed by the teacher, sometimes focusing on a specific multiplication table (Kiger et al., 2012). The comparison

group of students practiced multiplication for 10 minutes each day using flash cards, math games, fact triangles, and number sequences (Kiger et al., 2012).

Results from the pre-intervention survey indicate students' home technology environments were similar (Kiger et al., 2012). The participating teachers shared similar teaching experience and teaching styles, and years of experience (Kiger et al., 2012). Using a 10 minute, 100-item post-intervention paper and pencil multiplication test was administered in a group setting under standardized conditions (Kiger et al., 2012). Students had taken a similar timed, paper-and pencil 50-item multiplication pre-test. Students were advised not to worry if they do not finish the test. The post-test was used as the measure of the outcome in this experiment and was found to criterion-related valid. On average, the MLI students answered more items correctly on the post-test (M = 54.5, SD = 14.8) than the Comparison students (M = 46.3, SC = 12.5) (Kiger et al., 2012). Participating in the MLI group was the most influential factor of test performance as well as the student's math-related effort/attitude grade was also an influential predictor of test ability (Kiger et al., 2012). The post test was repeated again showing that the MLI students answered a greater number of problems (M = 11.6, SD = 4.9) with the Comparison students (M = 8.2, SD = 4.4) (Kiger et al., 2012).

Another study that supports BYOD was written by David Parsons (2012). For two years, Massey University researchers have been involved with a New Zealand school and their project to integrate one-to-one digital devices into a ninth grade classroom (Parsons, 2012). Students are between the ages of 13 and 14. This was the first year that the school required the parents provide the iPad2 device for their child's school use. The 'bring your own device' (BYOD) concept has grown from its initial stages to widespread in education over a short period of time (Parsons, 2012). 35.2% of secondary schools, 20% of intermediate schools and 6.9% of primary

schools already have a BYOD policy (Parsons, 2012). Investments for this project were made in network equipment and infrastructure, professional development, and management software systems. The school adopted Puentedura's model of substitution, augmentation, modification, and redefinition (SAMR). This model has four phases in the use of technology: direct tool replacement, augmentation, transformation, and redefinition. Each stage moves progressively through the learning process. According to Parsons (2012), the BYOD policy enables a move to a more student-centered approach to teaching and learning (Parsons, 2012). While the devices are used across multiple subject areas, there are ways in which teachers have tailored the device for use in their specific subject area content. Math games are used for learning in math while Mind mapping tools have proven useful in both drama and English classes, and in physical education the devices are used for analysis of physical performance (Parsons, 2012). Reports from teachers confirm that student collaboration is easier and staff collaboration more relevant and useful (Parsons, 2012).

An article written by Nathan Evans (2014) entitled "To BYOD or not to BYOD" discusses how keeping pace with unprecedented levels of technological advancement is one of the greatest challenges that schools face now. With so many students owning personal devices and being so accustomed to accessing those devices for information, it is almost un-natural to ask them to accept traditional school resources. Keeping the school's technology upgraded is very expensive so BYOD implementation is a way to address this issue. Not having to maintain or support hardware will certainly reduce the school's expenses. Another advantage of BYOD implementation does not have to deal with banning personal devices in the school.

Support for F/OSS

More and more schools are using free open source software (F/OSS) with administrative staff, teachers, as well as in the classroom due to limited budgets and cutbacks in school districts across the U. S. The F/OSS that was selected for this study by James Vajda and Jason Abbitt is OpenOffice suite (2011). This type of software can be downloaded, distributed, shared, modified, and redistributed without licensing or other costs for obtaining, installing, or using the software (Vajda & Abbitt, 2011). This software is very similar to Microsoft Office in performance and capabilities, and it is compatible with multiple operating systems includes Windows, Mac OSC, and Linux (Vajda et al., 2011). This mixed method study is an evaluation of a pilot implementation of OpenOffice with a K-12 school district in Ohio (Vajda et al., 2011). The decision to implement OpenOffice would depend upon the results of the study. Participants in the study were volunteers who included six high school teachers, two middle school teachers, and nine elementary school teachers (Vajda et al., 2011). Over a four-week period, 11 of the original 17 participants completed the study in the trial period (Vajda et al., 2011). All data for the study was submitted and approved by the Institutional Review Board. Before the participants began using OpenOffice, they completed a Computer System Usability Questionnaire (CSUQ). There were two voluntary training sessions offered to the participants with only two participants attending. After using OpenOffice for week one and week four, participants completed another survey. Interviews with participants were also conducted individually. Due to the small sample size of the study, analysis of the quantitative data was inadequate and limited to descriptive statistics and nonparametric deducible analyses (Vajda et al., 2011). Interview results and the open-ended questions were examined using content analysis methods to reveal common themes during the interviews. Seven participants thought that tasks performance of OpenOffice was

equivalent to Microsoft Office. Two users of OpenOffice had a negative opinion of the software. Regarding Quality of Interface, an analysis using Mann-Whitney *U* test found no significant differences between Microsoft Office and OpenOffice (Vajda et al., 2011). Overall usability of Microsoft Office and OpenOffice was analyzed using the Mann-Witney *U* test which found no significant difference in the software. Interview responses revealed that OpenOffice on PowerPC-based Apple computers were very slow starting up (Vajda et al., 2011). Two more problems were revealed during the interview: 1. Interactive use with whiteboard did not perform well with OpenOffice presentation application- 2. Clipart gallery was not as extensive on OpenOffice as was with Microsoft Office (Vajda et al., 2011). In the end, the conclusion was that OpenOffice would be accepted as a replacement for Microsoft Office. The issue with a slow start up for OpenOffice was ultimately the result of an older PowerPC computer with an older version of Java. The startup issue was resolved on the newer Intel-based Apple and Windows-based computers. Schools contemplating using OpenOffice would benefit from examining their support structure. Most FOSS does not have the online support system in place as the typical commercial software. The small study was intentional for this school district and meant to not interrupt ongoing school-related activities and functions; however, the same problems using OpenOffice would be expected to occur in a larger study.

An article written by John Waters discusses how OSS helped a school district near Seattle save thousands of dollars that they then turned around and spent on professional development for their teachers. The Apache web server is a software program that works with web pages and web browser. It is very popular with school districts. Moodle is another OSS that has been integrated into schools. Moodle is a replacement for Blackboard and with its popularity and successful implementation has led school districts to look at using more OSS. Audacity (free

audio recorder and editor) is popular with students to record podcasts and student speeches, promote language learning, add sounds to presentations, and create soundtracks for animations (Waters,- 2010). Other apps that are recommended in educational software are: GeoGebra, Stellariu, iTalc, GIMP, FreeMind, and Zimbra (Waters, 2010). Michigan City Area Schools in Michigan City, IN, opened two new elementary schools and loaded classrooms with OSS (Waters, 2010). According to their IT director, 95 percent of the software used in the two schools is OSS (Waters, 2010). According to the article, OpenOffice is used in many school districts across the country saving money for each district.

Pros to using 1-to-1 in a learning environment

The article by David Parsons (2012) that researched the project to integrate 1-to-devices into the 9th grade classroom extended into 2013 resulting in the project to including all grades. Parsons (2012) stated that in addition to the transformations of classroom practice, there are evolutionary changes in the ways that learning spaces may be utilized. The BYOD implementation makes it possible to move toward a more student-centered approach to teaching and learning. The use of the one-to-one digital device can be used in any subject area. For example, in science class, photos of various stages of experiments can be easily uploaded to for added visual images to enhance a report or study. Across the curriculum, collaboration, digital skills, and information literacy are common themes of integrating one-to-one devices (Parsons, 2012, p. 3). According to Parsons (2012), these lessons and activities are transformative, enhancing the learning process.

According to the article entitled "BYOD Strategies" (2012), the tech staff at New Canaan Public Schools knew that students would bring in their cell phones, so they created an open environment to support that. In 2011, 35% of the students used their own devices and by 2012,

the percentage was up to 45%. Some of the discussion in the school is about equity for all students and are against BYOD programs. However, this school has seen a positive relationship for the special education students that have assistive devices. Now the special education students do not feel like they are singled since other students are now bringing in their devices.

Challenges to using 1-to-1 in a learning environment

In an article written by Michael Grant and Michael Barbour (2013), they describe two projects to integrate mobile teaching and learning into K-12 schooling. The two projects discussed are: consideration for the increased use of mobile devices in schools and the growth of K-12 online learning. More relevant to this paper, they discuss challenges of integrating mobile learning in K-12. Many administrators see these devices as potential problems that may overshadow their usefulness as an educational tool. One of the expressed concerns was that school districts are reluctant to implementing BYOD programs due to regulations associated with the internet and the protection of children, because smart phones and cell phones may use cell networks that could bypass the school's network (Grant & Barbour, 2013). The second project discussed in the article discussed using iPads along with BYOD in a chemistry classroom. The apps (3D Cell, VCell, Mobl21) used for this lesson discussed in the article were loaded on the iPads as well as the personal devices that students brought into the class. The teacher began the class using mLCMS *Mobl2* while demonstrating the lesson using QR Reference and a document camera to project his iPad screen to the class (Grant et al., 2012). The students completed several activities and finally a quiz using their devices and preloaded apps. Both teacher and students felt that the integration of the devices was successful due to the engagement of the students during the lessons. "The teacher felt the potential use of the iPad as a classroom device was limited at present" (Grant et al., 2013, p. 3). The teacher expressed concern over the cost

and care of the iPads by the students. The largest concern about the potential use of these devices was ensuring a one-to-one student-to-device ratio (Grant et al., 2012). All of the teachers in this pilot study project felt without this student ratio, the probable success of the integration of these devices would be limited.

Pros to using FOSS in a learning environment

The article entitled "Blending Student Technology Experiences in Formal and Informal Learning," the authors discuss the significance of identifying students' technology-enhanced informal learning experiences and expand instruction to connect students' formal and informal learning experiences, in order to meet the demands of the knowledge society (Lai, Khaddage & Knezek, 2013). The Mobile-Blended Collaborative Learning model (MBCL) is proposed as a model to bridge the gap (Lai et al., 2013). Using three tools of mobile applications can enhance collaboration, coordination and communication to provide for valuable learning methods in the classroom. Below, Lai, Khaddage & Knezek (2013) propose the MCBL model as a step towards conceiving the use of mobile applications to connect the weakness of the formal learning pedagogies with the strengths of the informal learning pedagogies and vice versa. F/OSS provides applications that allow these technologies to open up new ways for students to learn. Applications for collaboration (such as Google Docs) can be used for sharing documents and files among students and teachers both in class and outside normal class hours (Lai et al., 2013). Applications for classroom management and announcements (such as Twitter) can be used to notify students regarding class assignments. Applications for building community-based learning activities (such as Facebook or Google+) can be used for communications, discussions, and sharing among students outside the normal classroom setting. According to Lai, Khaddage and Knezek (2013) in order for this connection between formal and informal learning, there are

infrastructural issues that need to be addressed, instigating a one-to-one computing initiative or BYOD model adopted.

Figure 1 **Mobile-Blended Collaborative Learning model**

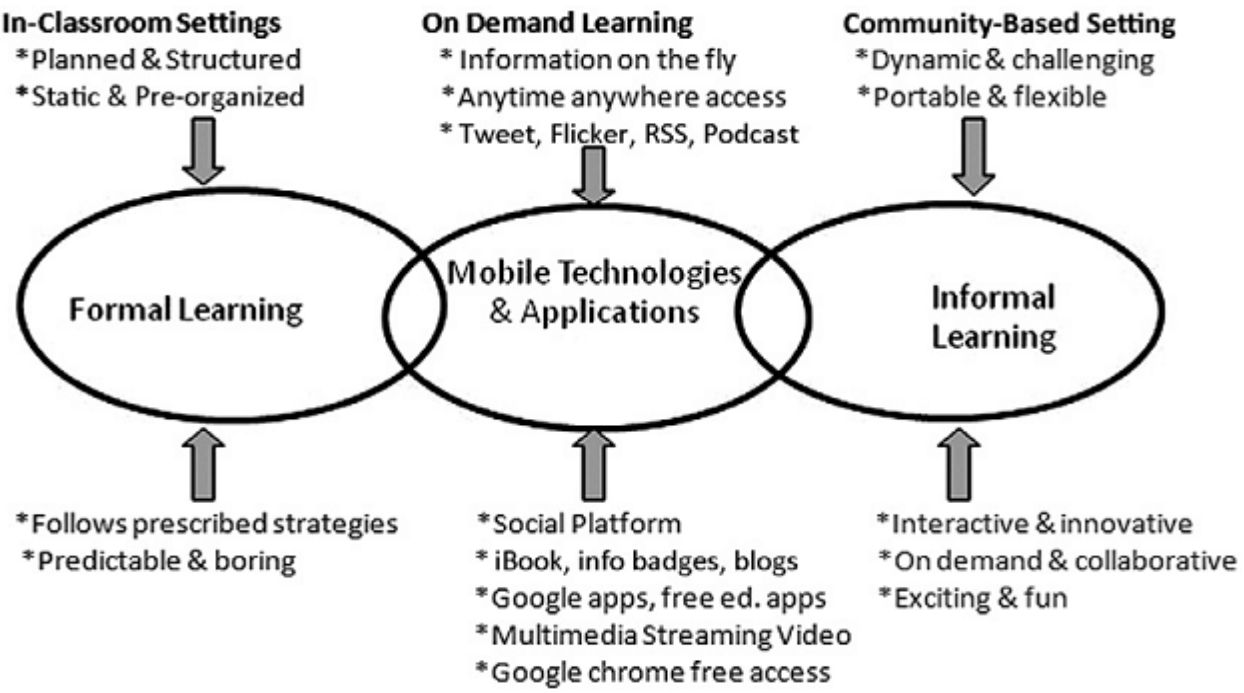

Figure 1. The model represents how mobile apps are being used.
Lai, K., Khaddaget, F., & Knezek, G. (2013). Blending student technology experiences in formal and informal learning. *Journal of Computer Assisted Learning*, *29.* 414-425.

Challenges with using F/OSS in a learning environment

"Tim Goree, director of technology services for Norris School District, Bakersfield, CA, estimated that it takes at least three years for a school district to become a "self-supporting open source IT department," even with help from an outside firm" (Wanchek, 2010, p. 1). The district was currently using Macs. In preparation for a transition to OSS, his first decision was to start using Zimbra for email services. Goree proposed putting $300 Linux-based computers instead of the more costly Macs based on a teacher survey and what programs they currently used. At the

time the survey was conducted, teachers were using their computers for Web/Internet applications, light word processing and presentations (Wanchek, 2010). One-hundred five student computers were purchased for the new schools. As more schools needed new computers, Goree continued purchasing a version of the Linux. However, for the teachers and computer labs, the district continued to purchase Macs that were high-end systems to use for video or photo editing. The challenge with the Linux system was the lower processing speeds which limited their use of OSS. The school did transition to OpenOffice because the Linux system does not work with Microsoft Office. After a few more projects with Revolution Linux, Goree says that he expects that his will be an "open source shop" that can implement OSS projects without outside assistance (Wanchek, 2010). The district is comprised of 3500 students with a total of five schools in K–8.

Two other school districts, one in San Antonio and one in Michigan City Schools in Indiana, converted to Open Source. Both districts agree that there were savings for their school districts. However, one issue in San Antonio was two programs they wanted to integrate, B2evolution and WordPress, did not take off, partly owing to account management with 3,000 teachers and 54,000 students (Wancheck, 2010). "We let these initiatives die because of support issues. If they had become popular, it would be overwhelming for a small staff" (Wancheck, 2010, p. 4). The Michigan City School district states that they are saving about $100,000 annually on licensing and they saved about $100,000 in hardware purchases. The IT director, Kevin McGuire, said that he realized he needed to purchase desktops for under $300 for their desired one-to-one initiative. The district hired Revolution Linux to change the infrastructure to open source. Since there is little support with OSS, the teachers have to learn the new software

as they go. Also, two of the programs that they had used, Scholastic Read 180 and Scientific Learning Fast ForWord, would not work on the Linux system.

Professional Development

http://www.npr.org/blogs/alltechconsidered/2012/10/03/162148883/some-schools-actually-want-students-to-play-with-their-smartphones-in-class

Ways to train the teachers to use BYOD

When you have a great teacher ultimately you will have a great student. In order to become a great teacher, one must be highly developed and to be highly developed one must need professional development to achieve this goal. When a teacher is inspiring and well informed it influences student achievement. It is important that we pay attention to how we train and support our educators. Technology is the new norm for professional development because it is so pervasive in the lives of our students. The article entitled "On Board with BYOD" states, professional development must help teachers create classroom guidelines for technology use and help them develop lessons and methodologies that productively use these devices—for example, student polling; real-time researching, writing and peer editing; consulting experts; and constructing multimedia projects (Johnson, 2012).

When we walk into a classroom, what do we see? Some classrooms have desktops, while others may have mobile laptops or tablets carts. Technology has transformed the way we work, play, travel, and inevitably the way we think. Technology has caused an evolution in learning process when it has been integrated in the curriculum properly. The integration of technology has improved students' learning processes and outcomes. When teachers realize the benefits of

using technology, they can then view computers as problem-solving tools and move from a behavioral approach to a constructivist approach. When this happens students are more engaged in their learning and can become creators and not just consumers.

In order to lead students in this tech savvy world, teachers themselves must be ready to adapt and adjust to the numerous amount of changes that is occurring when it comes to technology. Teachers should be given the opportunity to attend weekly, monthly and even yearly professional development sessions that gives them a chance to explore ways to use personally owned devices that can incorporated into their instruction. How can we make preparations to teach a BYOD class? One way is by building adequate time into the school day. This allow teachers to become more familiar with technology use. Consider giving teachers scheduling times during the day or after school for shared activities using technology. These factors will contribute to the popularity of encouraging students to bring their own personal technologies to school and use them for learning. How can teachers and administrators influence the additional of using personal devices into the classroom? What are ways in which teachers and administrators can make BYOD happen?

One way of making this happen is to make sure teachers are aware of applications and teaching strategies that use personal technologies to increase student engagement. Another way is to have the PD coordinator have one to one PD with staff at thier request along with the whole school PD. Their should be structure. For example, after school session, one to one departmental meeting are all ways of providing PD. PD should have a purpose. While conducting PD emphasize the benefits and link to research, show why how it can improve classroom practice. There should be a stronger foundation. Teachers should be given the time to reflect and evaluate their practices. They should also be allowed to share their ideas and give

feedbacks. Allow for teachers who have grasp the use of using integrating BYOD share good practices with the rest of the staff. PD that is implemented should focus on student outcome, which is teaching and learning.

Ways to find, evaluate, and use F/OSS

Open Source Software/Free Software (F/OSS) is a phenom that has grown to be very promising. F/OSS allows anyone to freely use, study, copy, and change software to be used as best see fit by the user. How can one know what F/OSS best suit your needs? What are ways we can find and evaluate F/OSS?

To know which F/OSS to use you should identify potential software, read existing reviews, compare leading programs to your needs and then test or do an in-depth analysis/comparison of the top candidates. Identifying potential software is important because it helps you to find out options. Using a combinations of techniques is helpful to make sure that nothing important is being missed. Running different search engines is helpful as well. For example Google, Teoma, Alltheweb and AltaVista are good search engines to consider. Once your options have been identified, it's a great idea to read existing reviews. You can learn more about a program's strengths and weaknesses by reading the review. The easiest way to read a review is to do a google search. After you have identify the leading software and read the reviews, you can now narrow down the contenders to best suit your needs there is where you would evaluate important attributes such as functionality, cost, support, maintenance, reliability, performance, usability, flexibility/customizability and legal/license issues. Once the top contenders have been identified, a more in-depth analysis can be performed. This in-depth performance should focus on functionality and security.

Gaps in the Research for Further Study

Further research could include looking at the transition from K-12 education to college/career preparedness among students. It is important to fully develop the technological abilities of these students. By researching how prepared students truly are when it comes to leaving the K-12 environment and venturing out into higher education, we as K-12 educators can look at the gaps and help to better prepare those students throughout their K-12 experience. Another study that can be looked at would be the technological implementation of core subjects and overall student performance and growth. Since the new Common Core standards have a technology component that helps to foster STEM requirements, it is important to look at the growth in those areas based on the technology implementation and new standard requirements. Research will be able to determine if students are truly mastering the standards or may need additional interventions to support the learning and skills being taught. As always, when it comes to looking at new technology and new skills being implemented into the curriculums, districts should not only investigate what is working but also investigate what needs to be improved and how to make those improvements through data collection and research.

Conclusion

Based on the findings by the authors, BYOD usage in schools will ultimately improve the students learning experience. BYOD along with F/OSS usage will allow schools that are struggling financially to incorporate more technology into the student's day to day learning which in return, will prepare our graduating seniors for the 21st century workforce. K-12 schools are still in the learning stages when it comes to technology integration and implementation. Once these schools fully implement 1-to-1 approaches, students will be better prepared for the different stages of K-12 education and eventually college and/or career. Eventually schools will find that the BYOD movement will allow for more of an individualized approach to learning and one that will allow teachers to become more of a facilitator of learning while the student develops the want to learn and research on their own which will promote critical thinking and problem solving, skills that are needed in the 21st century work world.

BYODOSS Group Wiki Final Exam Questions

1. What device(s) is now one of the most used for 1-to-1/BYOD programs in K-12 schools?

    a. Windows Laptop

    b. Mac laptop

    c. Chromebook

    d. Tablets

    e. Both c and d

2. Open Source Software is all of the following except:

    a. Always free

    b. Can be tuned to best suit your educational needs

    c. Flexible license structure

    d. Is designed to be used regardless of computing platform

    e. Difficult to use in most educational settings

3. This is the acronym for software that is free, Open Source, and usually unlimited license use:

    a. OSS

    b. FOSS

    c. BYOD

    d. BYOD/OSS

    e. BYOD/FOSS

4. Short answer: How might BYOD utilize F/OSS in order to help ensure affordable digital equity?

5. Short answer: How is BYOD seen as a natural fit for educating the 21st century learner?

6. Short answer: Why is F/OSS seen as an attractive alternative for schools when compared to name brand software?

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